Ket Practice

Physics II: Modern Physics

College of the Atlantic

1. Let $|\psi\rangle = 3|+\rangle + 4|-\rangle$. Evaluate the following:
   (a) $\langle +|\psi\rangle$
   (b) $\langle -|\psi\rangle$
   (c) $\langle \psi|\psi\rangle$

2. Let $|\psi\rangle = |+\rangle - i|-\rangle$. Evaluate the following:
   (a) $\langle +|\psi\rangle$
   (b) $\langle -|\psi\rangle$
   (c) $\langle \psi|\psi\rangle$

3. Let $|\psi\rangle = C(|+\rangle + i|-\rangle)$. Find the C that makes $\langle\psi|\psi\rangle = 1$.

4. Let $|\psi\rangle = C(-3i|+\rangle + 2|-\rangle)$. Find the C that makes $\langle\psi|\psi\rangle = 1$.

5. Suppose an atom is in a state described by

$$|\psi\rangle = \frac{3}{5}|+\rangle + \frac{4}{5}|-\rangle \, . \tag{1}$$

   (a) If one performs a z-spin measurement on this atom, what is the probability that the result would be +1?
   (b) If one performs a z-spin measurement on this atom, what is the probability that the result would be +1?

6. The x states are given by:

$$|+\rangle_x = \frac{1}{\sqrt{2}}\left(|+\rangle + |-\rangle\right) \, . \tag{2}$$

$$|-\rangle_x = \frac{1}{\sqrt{2}}\left(|+\rangle - |-\rangle\right) \, . \tag{3}$$

   (a) What is ${}_x\langle x|-\rangle_x$?
   (b) Verify that ${}_x\langle x|-\rangle$ is what it should be.